

What is claimed is:

1. A system for cooling electronic components, the system comprising:
a surface;
5 one or more electronic components coupled to the surface; and
a blower coupled to the surface, the blower having a first port, a
second port, and an impeller which rotates around an axis, the blower
oriented such that the first port faces the surface so that air flowing across the
first port flows through a channel formed by the blower and the surface,
10 wherein the blower moves air across the one or more electronic components.
2. The system according to claim 1, wherein the surface is a circuit board.
3. The system according to claim 1, wherein air flows into the first port and
15 exits the second port.
4. The system according to claim 1, wherein air flows into the second port
and exits the first port.
- 20 5. The system according to claim 1, wherein the system has a height of less
than 1.75".
6. A system for cooling electronic components, the system comprising:
a surface;
25 one or more electronic components coupled to the surface; and
a blower coupled to the surface, the blower having a first port, a
second port, and an impeller which rotates around an axis, the blower
oriented such that the first port faces the surface, the first port located above
at least one of the one or more electronic components coupled to the surface
30 such that air flowing through the first port flows across the at least one of the
one or more electronic components.

7. The system according to claim 6, wherein the surface is a circuit board.

8. The system according to claim 6, wherein air flows into the first port and exits the second port.

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9. The system according to claim 6, wherein air flows into the second port and exits the first port.

10. The system according to claim 6, wherein the one or more electronic components includes:

an integrated circuit coupled to a heat sink, wherein the blower is arranged beside the heat sink to provide at least one airflow path between the second port of the blower and the heat sink that is parallel to the plane of the surface.

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11. The system according to claim 10, wherein air flowing across the heat sink also flows across at least one of the one or more electronic components coupled to the surface.

12. The system according to claim 10, further comprising a shroud positioned such that air flowing through the second port is substantially directed across the heat sink.

13. The system according to claim 6, wherein the system has a height of less than 1.75".

14. The system according to claim 6, further comprising a 1U enclosure, the system enclosed within the 1U enclosure.

15. A rack comprising:

a mounting fixture; and

a plurality of the systems of claim 6 mounted in parallel.

16. A system for cooling electronic components, the system comprising:
a surface;
one or more electronic components coupled to the surface, the one or
5 more electronic components including an integrated circuit in contact with a
heat sink; and
a blower coupled to the surface, the blower having a first port, a
second port, and an impeller which rotates around an axis, the blower
arranged beside the heat sink to provide at least one air path between the
10 second port of the blower and the heat sink that is parallel to the plane of the
surface.
17. The system according to claim 16, wherein the surface is a circuit board.
- 15 18. The system according to claim 16, wherein air flows into the first port and
exits the second port.
19. The system according to claim 16, wherein air flows into the second port
and exits the first port.
- 20 20. The system according to claim 16, wherein the blower is oriented such that
the first port faces the surface so that air flowing across the first port flows
between the blower and the surface.
- 25 21. The system according to claim 20, wherein the first port is located above at
least one of the one or more electronic components coupled to the surface,
such that air flowing through the first port flows across the at least one of the
one or more electronic components.
- 30 22. The system according to claim 16, wherein air flowing across the heat sink
also flows across at least one of the one or more electronic components
coupled to the surface.

23. The system according to claim 16, further comprising a shroud positioned such that air flowing through the second port is substantially directed across the heat sink.

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24. The system according to claim 16, wherein the system has a height of less than 1.75".

25. The system according to claim 16, further comprising a 1U enclosure, the
10 system enclosed within the 1U enclosure.

26. A rack comprising:

a mounting fixture; and

a plurality of the systems of claim 16 mounted in parallel.

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27. A system for cooling electronic components, the system comprising:

a surface;

one or more electronic components coupled to the surface, the one or more electronic components including an integrated circuit in contact with a

20 heat sink; and

a blower coupled to the surface, the blower having a first port, a second port, and an impeller which rotates around an axis, the blower oriented such that the axis is perpendicular to the surface and non-intersecting with the heat sink, wherein the blower moves air across the heat
25 sink.

28. The system according to claim 27, wherein the surface is a circuit board.

29. The system according to claim 27, wherein air flows into the first port and
30 exits the second port.

30. The system according to claim 27, wherein air flows into the second port and exits the first port.

31. The system according to claim 27, wherein the blower is oriented such that
5 the first port faces the surface so that air flowing across the first port flows between the blower and the surface.

32. The system according to claim 31, wherein the first port is located above at least one of the one or more electronic components coupled to the surface,
10 such that air flowing through the first port flows across the at least one of the one or more electronic components.

33. The system according to claim 27, wherein air flowing across the heat sink also flows across at least one of the one or more electronic components
15 coupled to the surface.

34. The system according to claim 27, further comprising a shroud positioned such that air flowing through one of the first port and the second port is substantially directed across the heat sink.

20 35. The system according to claim 27, wherein the low profile system has a height of less than 1.75".

36. The system according to claim 27, further comprising a 1U enclosure, the
25 system enclosed within the 1U enclosure.

37. A rack comprising:
a mounting fixture; and
a plurality of the systems of claim 27 mounted in parallel.

30 38. A cooling cartridge for attaching to a surface, the cartridge comprising:
a shroud;

a heat sink coupled to the shroud;
a blower coupled to the shroud, the blower having an impeller axis
non-intersecting with the heat sink.

5 39. The cartridge according to claim 38, wherein the heat sink is coupled to a
heat conductor, the heat conductor further coupled to a mounting plate.

40. The cartridge according to claim 39, wherein the heat conductor is flexible.

10 41. The cartridge according to claim 39, wherein the heat conductor is
removably coupled to the heat sink.

42. A method for cooling one or more electronic components attached to a
surface, the method comprising:

15 generating airflow across a heat sink using a blower, the heat sink
coupled to an integrated circuit coupled to the surface, the blower having a
first port, a second port, and an impeller which rotates around an axis, the
blower coupled to the surface such that the axis is perpendicular to the
surface and non-intersecting with the heat sink.

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43. The method according to claim 42, wherein directing airflow to the heat
sink, air moving across the heat sink also flows across one or more electronic
components coupled to the surface.

25 44. The method according to claim 42, wherein generating airflow includes
moving air past at least one electronic component attached to the surface
beneath the first port of the blower, the first port of the blower facing the
surface so that air flowing across the first port flows between the blower and
the surface.

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45. A system for cooling electronic components, the system comprising:
a first surface;

one or more electronic components coupled to the first surface, the one or more electronic components including an integrated circuit; and

a module attached to a second surface, the module including:

a heat sink for removing heat from the integrated circuit;

5 a blower for moving air across the heat sink and also across at least one of the one or more electronic components.

46. The system according to claim 45, wherein the first surface and the second surface are non-overlapping.

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47. The system according to claim 45, wherein the second surface is located above the first surface.

48. The system according to claim 45, wherein the heat sink is coupled to a

15 heat conductor, the heat conductor further coupled to a mounting plate, the mounting plate thermally coupled to the integrated circuit.

49. The system according to claim 45, wherein the blower has an impeller axis that is perpendicular to the plane of the first surface.

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50. The system according to claim 45, wherein the blower provides at least one airflow path between a port of the blower and the one or more electronic components that is parallel to the plane of the first surface.

25 51. A system for cooling electronic components, the system comprising:

a first surface;

one or more electronic components coupled to the first surface, the one or more electronic components including an integrated circuit; and

a module coupled to and positioned beside the first surface, the

30 module including:

a heat sink for removing heat from the integrated circuit;

a blower for moving air across the heat sink and also across at least one of the one or more electronic components.

52. The system according to claim 51, wherein the heat sink is coupled to a
5 heat conductor, the heat conductor further coupled to a mounting plate, the mounting plate thermally coupled to the integrated circuit.

53. The system according to claim 51, wherein the blower has an impeller axis that is perpendicular to the plane of the first surface.

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54. The system according to claim 51, wherein the blower provides at least one airflow path between a port of the blower and the one or more electronic components that is parallel to the plane of the first surface.

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